

Report Documentation Page				Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.						
1. REPORT DATE <b>21 JUL 2006</b>		2. REPORT TYPE <b>Technical</b>		3. DATES COVERED <b>10-02-2006 to 22-07-2006</b>		
4. TITLE AND SUBTITLE <b>Aluminum / Silicon Carbide Matrix Material Machining for Targeting Systems</b>				5a. CONTRACT NUMBER		
				5b. GRANT NUMBER		
				5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)				5d. PROJECT NUMBER <b>06-0081-02</b>		
				5e. TASK NUMBER		
				5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>National Center for Defense Manufacturing &amp; Machining,1600 Technology Way,Latrobe,PA,15650</b>				8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)		
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>						
13. SUPPLEMENTARY NOTES						
14. ABSTRACT <b>Lockheed Martin Missiles and Fire Control (LMMFC) of Orlando, FL, is currently in the process of producing components using Metal Matrix Composite (MMC) materials. This material is most desirable in high performance applications due to the improved material properties over monolithic metals. The most common MMC is cast aluminum reinforced with various amounts of silicon carbide. LMMFC is currently machining very high precision components for targeting systems made from cast aluminum/silicon carbide (AISIc) matrix material (with a very high SiC content) and is experiencing difficulty achieving the accuracy required due to excessive tool wear and failure from the properties of this material. Due to the increased demand for the manufacturing of targeting system components made from AISIc matrix material, LMMFC called upon the National Center for Defense Manufacturing and Machining (NCDMM) to research and provide a more efficient solution to produce these components to specifications required by LMMFC.</b>						
15. SUBJECT TERMS <b>NCDMM; Metal Matrix Composite materials; Lockheed Martin Missiles and Fire Control; National Center for Defense Manufacturing and Machining</b>						
16. SECURITY CLASSIFICATION OF:				17. LIMITATION OF ABSTRACT <b>1</b>	18. NUMBER OF PAGES <b>1</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>				

# Aluminum / Silicon Carbide Matrix Material Machining for Targeting Systems

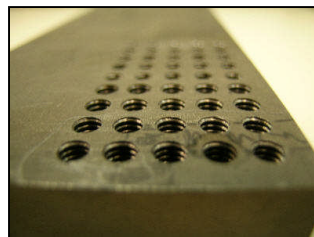
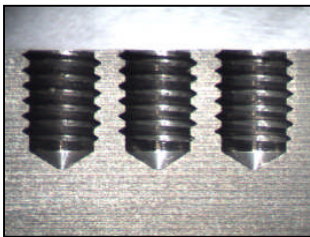
NCDMM Project No. 06-0081-02

## PROBLEM / OBJECTIVE

Lockheed Martin Missiles and Fire Control (LMMFC) of Orlando, FL, is currently in the process of producing components using Metal Matrix Composite (MMC) materials. This material is most desirable in high performance applications due to the improved material properties over monolithic metals. The most common MMC is cast aluminum reinforced with various amounts of silicon carbide. LMMFC is currently machining very high precision components for targeting systems made from cast aluminum/silicon carbide (AlSiC) matrix material (with a very high SiC content) and is experiencing difficulty achieving the accuracy required due to excessive tool wear and failure from the properties of this material.

Due to the increased demand for the manufacturing of targeting system components made from AlSiC matrix material, LMMFC called upon the National Center for Defense Manufacturing and Machining (NCDMM) to research and provide a more efficient solution to produce these components to specifications required by LMMFC.

## ACCOMPLISHMENTS / PAYOFF



Tests were conducted by thread milling  
#6-32 & #8-32 in the AlSiC material.

### Process Improvement

The NCDMM initiated the development of a solution by having test material, supplied by LMMFC sent to the NCDMM testing and development lab. The first phase of testing began by researching various tool geometries and the coatings that are associated with them. Once the cutting tool geometries were selected, they were tested and evaluated. Photos of

the tools were taken, tool wear was measured and all the data was recorded.

Test data results showed excessive tool wear, along with flaking of the tool's coating. In order to enhance the quality of the coating, the NCDMM investigated the use of a more advanced tool coating along with implementation of new machining methodologies.

Follow-up test results showed a significant improvement to the tool wear issue. The NCDMM, with the assistance of its Alliance Partners, was able to combine key technologies and develop an advanced cutting tool that would efficiently produce these components to specifications required at the LMMFC facility.

### Implementation and Technology Transfer

The following process and tool recommendations were made to LMMFC:

- Verification of the process to be implemented at LMMFC
- New advanced cutting tool technology tailored for machining very high precision components

### Expected Benefits from the new Tool Geometry

- Increased productivity
- Thread milling instead of hand tapping
- Better part quality
- Greater use of AlSiC material components is now possible

## TIME LINE / MILESTONE

Start Date..... February 06  
Recommendations Made..... July 06

## PROJECT FUNDING

NCDMM Effort .....\$70K

## PARTICIPANTS

Diamond Tool Coating  
Lockheed Martin Missiles & Fire Control, Orlando, FL  
Precorp  
Threadmills USA

For additional information concerning this project,  
contact the NCDMM at [www.ncdmm.org](http://www.ncdmm.org)